ZooKeys 718: 35–64 (2017)
doi: 10.3897/zookeys.718.19959
http://zookeys.pensoft.net

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

Two new species of the genus *Emertonia* Wilson, 1932 from Korean waters (Copepoda, Harpacticoida, Paramesochridae)

Jinwook Back[1], Wonchoel Lee[2]

1 *Department of Taxonomy and Systematics, National Marine Biodiversity Institute of Korea, Seocheon 33662, Korea* **2** *Department of Life Science, College of Natural Sciences, Hanyang University, Seoul 04763, Korea*

Corresponding author: *Wonchoel Lee* (wlee@hanyang.ac.kr)

Academic editor: *K.H. George* | Received 1 August 2016 | Accepted 23 October 2017 | Published 4 December 2017

http://zoobank.org/2EFE0195-2167-4FCA-8DAC-44E14CB9BBD0

Citation: Back J, Lee W (2017) Two new species of the genus *Emertonia* Wilson, 1932 from Korean waters (Copepoda, Harpacticoida, Paramesochridae). ZooKeys 718: 35–64. https://doi.org/10.3897/zookeys.718.19959

Abstract

Two new species of the genus *Emertonia* were found from the west coast of Korea. The first new species, *E. koreana* **sp. n.**, is closely related to *E. acutifurcata*. However, the new species is clearly distinguished by the presence of two modified pinnate setae on the P5 baseoendopodal lobe. All body somites of the new species except for the last two urosomites have strongly developed hyaline frills forming quadrilateral lappets. The second new species, *E. simplex* **sp. n.**, superficially resembles *E. mielkei* in the structure of antennary exopod (with five setae), and the shape of P5. However, this new species differs from its congener mainly by having a caudal ramus 3.5 times as long as width, and P1 enp-2 with two claw-like setae. In addition, a key to the worldwide species of *Emertonia* is provided.

Keywords

Crustacea, Jeju Island, *Kliopsyllus*, Taxonomy, Yellow Sea

Introduction

The family Paramesochridae consists of 13 genera and more than 150 species distributed worldwide. Within the family, the genus *Emertonia* Wilson, 1932 is seen to be the most species-rich genus. Despite the rich diversity, there are still many unidentified species to be regarded as new species within the genus (Plum and George 2009; Back and Lee 2014). According to Plum and George (2009), most of the species of

Copyright *Jinwook Back, Wonchoel Lee*. This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Emertonia are discovered in the interstitial and coastal zone with an exception to four species found from the deep sea, *E. andeep* (Veit-Köhler, 2004), *E. diva* (Veit-Köhler, 2005), *E. minor* (Vasconcelos, Veit-Köhler, Drewes & Parreira dos Santos, 2009), and *E. schminkei* (Veit-Köhler & Drewes, 2009).

Kunz (1962) divided the family Paramesochridae into nine genera based on the segmentation, and setae formula of swimming legs. Although Kunz (1962) proposed the name *Kliopsyllus* with the generic diagnosis based on four species (*Leptopsyllus coelebs* Monard, 1928; *Paramesochra holsatica* Klie, 1929; *L. constrictus* Nicholls, 1935, and *P. major* Nicholls, 1939) and two sub-species (*P. holsatica varians* Kunz, 1951, and *P. constricata orotavae* Noodt, 1958), he failed to fix the type species for the genus. Huys (2009) claimed that *Emertonia* Wilson, 1932 is the replacement name for *Kliopsyllus*. To date, 48 species including six sub-species have been reported in *Emertonia*, and most species are found from sandy sediments.

In Korea, taxonomic studies on coastal benthic copepods are underway. Song et al. (2012) summarized the marine and brackish-water harpacticoids found in Korea. They reported a list including 88 marine and brackish-water harpacticoids belonging to 23 families (Song et al. 2012). Especially in the case of the family Paramesochridae, 11 species are found in the coastal sandy sediments (Back and Lee 2014; Back and Lee 2017). As a part of ongoing taxonomical study on the harpacticoid copepods, we aim to describe two new species of *Emertonia* sampled from sandy beaches in Korean Waters.

Materials and methods

The sediment samples for *Emertonia koreana* sp. n. were collected from the Chulripo Beach in the west coast of the Korean peninsula. The sediment samples for *E. simplex* sp. n. were collected from a subtidal zone of Jeju Island. Samples were fixed with 5% buffered formalin and dissected specimens were mounted on several slides separately using lactophenol as mounting medium. Slides were sealed with transparent nail varnish. Observations of the specimens were carried out using an LEICA DM 6000 equipped with a drawing tube. Specimens were deposited in the Marine Biodiversity Institute of Korea (MABIK).

To prepare specimens for scanning electron microscope analysis (SU3500; Hitachi, in National Marine Biodiversity Institute of Korea), specimens were transferred to 100 % ethanol, dehydrated by t-BuOH freeze dryer (VFD-21S; Vacuum Device), mounted on stubs using double-sided tape, coated with gold-palladium, and then photographed.

The descriptive terminology was adopted from Huys et al. (1996). Abbreviations used in the text are:

A1 antennule;
A2 antenna;
ae aesthetasc;
exp exopod;
enp endopod;
exp (enp)-1 **(2, 3)** to denote the proximal (middle, distal) segment;
P1–P6 first to sixth thoracopod;
benp baseoendopod.

Systematics

Order Harpacticoida Dana, 1846
Family Paramesochridae Lang, 1944
Genus *Emertonia* Wilson, 1932

***Emertonia koreana* sp. n.**
http://zoobank.org/FE323D1F-32E2-412B-93DF-38AFF9B6A2BF
Figs 1–5

Type locality. The Chulripo Beach, intertidal zone in the west coast of Korea, Yellow Sea (36°48'11.46"N, 126°08'58"E) by sand rinsing collected by J. Back on 14 May 2010 (Back and Lee 2014, as *Emertonia* sp. 3)

Material examined. Holotype 1♀ dissected on 4 slides (MABIK CR00241565). Paratypes: 1♂ on 3 slides (MABIK CR00241566), and 5 ♀♀ (MABIK CR00241570 – 00241574), 3 ♂♂ (MABIK CR00241567 – CR00241569) in 70 % ethanol. 1♀ and 1♂ dried, mounted on stub, and coated with gold-palladium for SEM.

Diagnosis. Female P5 deeply divided into two parts in the center of both P5 baseoendopods. Two setae of baseoendopod swollen near the base. Innermost seta of P5 exopods somewhat swollen at base, similar to setae of baseoendopod. Urosomites armed with rectangular frills, except for the last two segments.

Description of female. Body. Length 330 μm (n = 6, mean = 325 μm); largest width measured at cephalic shield; 55 μm; cylindrical, slightly depressed dorsoventrally; whole body very hyaline; sensilla and pores on dorsal surface as figured (Fig. 1A, B).

Prosome (Fig. 1A, B). Comprising cephalothorax, and three free pedigerous somites; cephalothorax bell-shaped, with sensilla and pores as figured; pleural areas weakly developed and posterolateral angles rounded; posterior margin smooth; somites bearing P2–P4 with strongly developed hyaline frills forming quadrilateral lappets (Fig. 1A–C).

Urosome (Fig. 1A–C) Genital somite and first abdominal somite completely fused forming genital double-somite; genital field located mid-ventrally at approximately half length of genital double-somite; copulatory pore presumably covered by P6; P6 (Figs 1C, 5C) represented by one plate with one uni-pinnate seta each side; penultimate somite with bilobed, smooth pseudoperculum; anal somite small, with two pores dorsally.

Caudal ramus (Figs 1D, E, 5A). Juxtaposed, approximately 2.8 times as long as greatest width, conical, distal margin acutely pointed; each ramus armed with seven setae; seta I small, bare, arising ventrally; seta II bare; setae III stout, ornamented with spinule-like elements; seta IV bare; seta V pinnate, longest; seta VI shortest, bare; setae IV–VII displaced onto dorsal surface of ramus; seta VII bi-articulate at base and arising from inner dorsal surface.

Rostrum (Fig. 1A). Triangular, ventrally directed, fused with cephalic shield, without sensilla.

Antennule (Fig. 2A). Eight-segmented; proximal segment longest and ornamented with a few long spinules along lateral margin; fourth segment (Fig. $2A_1$) forming sub-

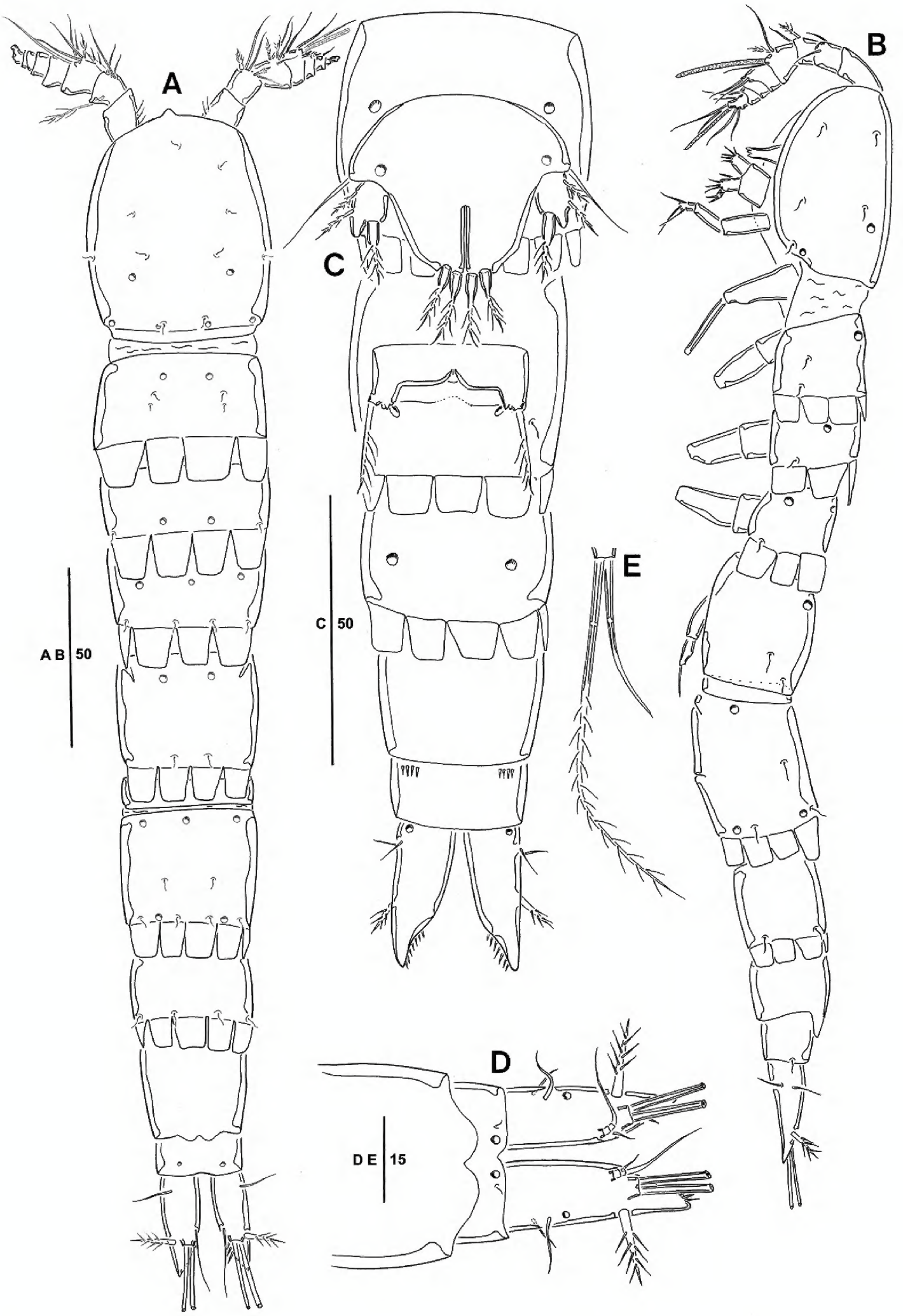

Figure 1. *Emertonia koreana* sp. n., holotype (♀). **A** habitus, dorsal **B** habitus lateral **C** urosome, ventral **D** caudal rami, dorsal **E** caudal seta IV and V. Scale bars are in μm.

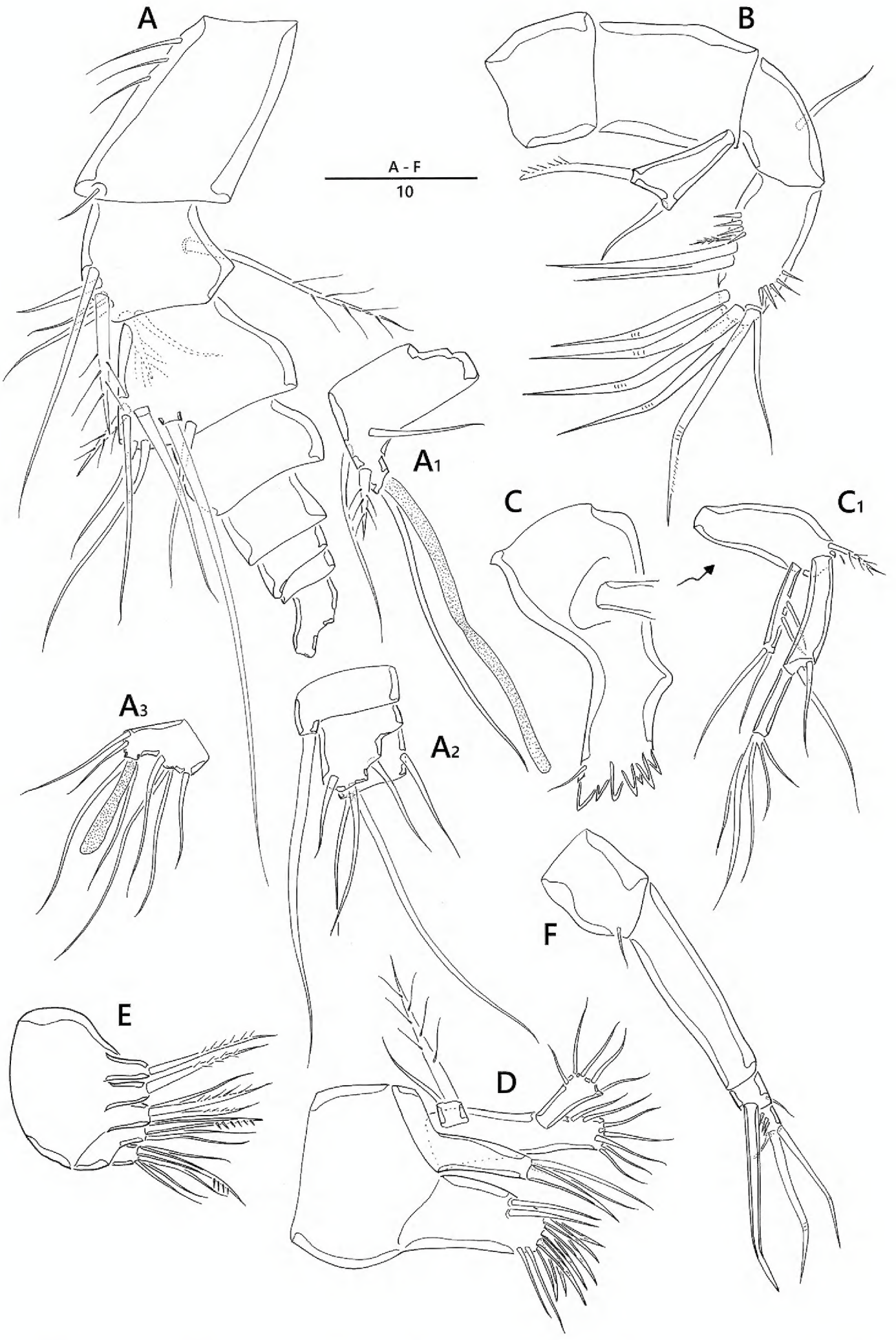

Figure 2. *Emertonia koreana* sp. n., holotype (♀). **A** antennule (**A**$_1$ fourth segment **A**$_2$ fifth, sixth, and seventh segments **A**$_3$ last segment) **B** antenna **C** mandible (**C**$_1$ plap) **D** maxillule **E** maxilla **F** maxilliped. Scale bar is in μm

cylindrical process armed with one long slender seta fused basally to aesthetasc; sixth segment (Fig. $2A_2$) armed with one slender bare seta arising from ventral sub-cylindrical process; armature formula: 1 – [1 bare], 2 – [5 bare + 3 pinnate], 3 – [6 bare + 1 pinnate], 4 – [2 bare + 1 pinnate + (1 + ae)], 5 – [1 bare], 6 – [3 bare], 7 – [3 bare], 8 – [6 bare + acrothek]; apical acrothek (Fig. $2A_3$) consisting of short aesthetasc fused basally to two naked setae.

Antenna (Fig. 2B). Four-segmented, comprising coxa, basis, one-segmented exp, and two-segmented enp; coxa small and bare; basis without any surface ornamentation; exp unequal Y-shape with one bare and one uni-pinnate setae; enp-1 with one bare abexopodal seta; enp-2 armed with one pinnate spine, two spine-like setae laterally, four geniculate setae around distal margin, and one longest geniculate seta fused at base with one bare seta.

Mandible (Fig. 2C). Coxa with gnathobase bearing one bare seta at dorsal corner and seven teeth; palp (Fig. $2C_1$) biramous, comprising basis, one-segmented exp and two-segmented enp; basis widening distally, with one pinnate seta; exp with two lateral and two distal setae; enp-1 with two bare setae; enp-2 with five basally fused setae at apex.

Maxillule (Fig. 2D). Praecoxal arthrite well developed, with seven spines, two bare setae around distal margin, and two juxtaposed slender setae on anterior surface near outer margin; coxa fused with cylindrical endite, armed with two bare setae and one stout spine; basis fused with endite, armed with seven bare setae; exp one-segmented, small, with one bare and one pinnate setae; enp one-segmented, with five bare setae.

Maxilla (Fig. 2E). Syncoxa with three endites; proximal and second endites with one pinnate seta; third endite with one bare and two uni-pinnate setae; allobasis with one strong pinnate claw and two bare setae; enp one-segmented, with one stout spine and four bare setae.

Maxilliped (Fig. 2F) four-segmented, comprising syncoxa, basis and two-segmented enp; syncoxa with one bare seta distally; basis bare; enp-1 with one geniculate and one small setae; enp-2 small, with two geniculate and one bare setae around distal margin.

P1 (Fig. 3A). Coxa ornamented with rows of spinules; basis with one pinnate inner seta and one bare outer seta, and ornamented with one pore near base of outer seta; enp 1.9 times as long as exp; exp two-segmented; exp-1 with one pinnate outer seta; exp-2 short, sub-quadrilateral, with three pinnate and one uni-pinnate setae; enp two-segmented; enp-1 long, bare; enp-2 small, with two short geniculate setae.

P2, P3 (Fig. 3B, C). Coxa ornamented with rows of spinules; basis with one bare outer seta, one pore near base of exp, and rows of spinules as figured; exp three-segmented; exp-1 with one outer spine and ornamented with row of long spinules along inner margin; exp-2 with one outer spine, inner distal corner forming spinous projection; exp-3 with two outer spines and two pinnate setae; enp one-segmented, with one plumose apical seta.

P4 (Fig. 3D). Coxa ornamented with two rows of spinules on anterior surface; basis with one bare outer seta and one pore; exp three-segmented; exp-1 and exp-2 with one outer spine; exp-3 with one outer spines and one pinnate apical seta; enp one-segmented with one apical seta.

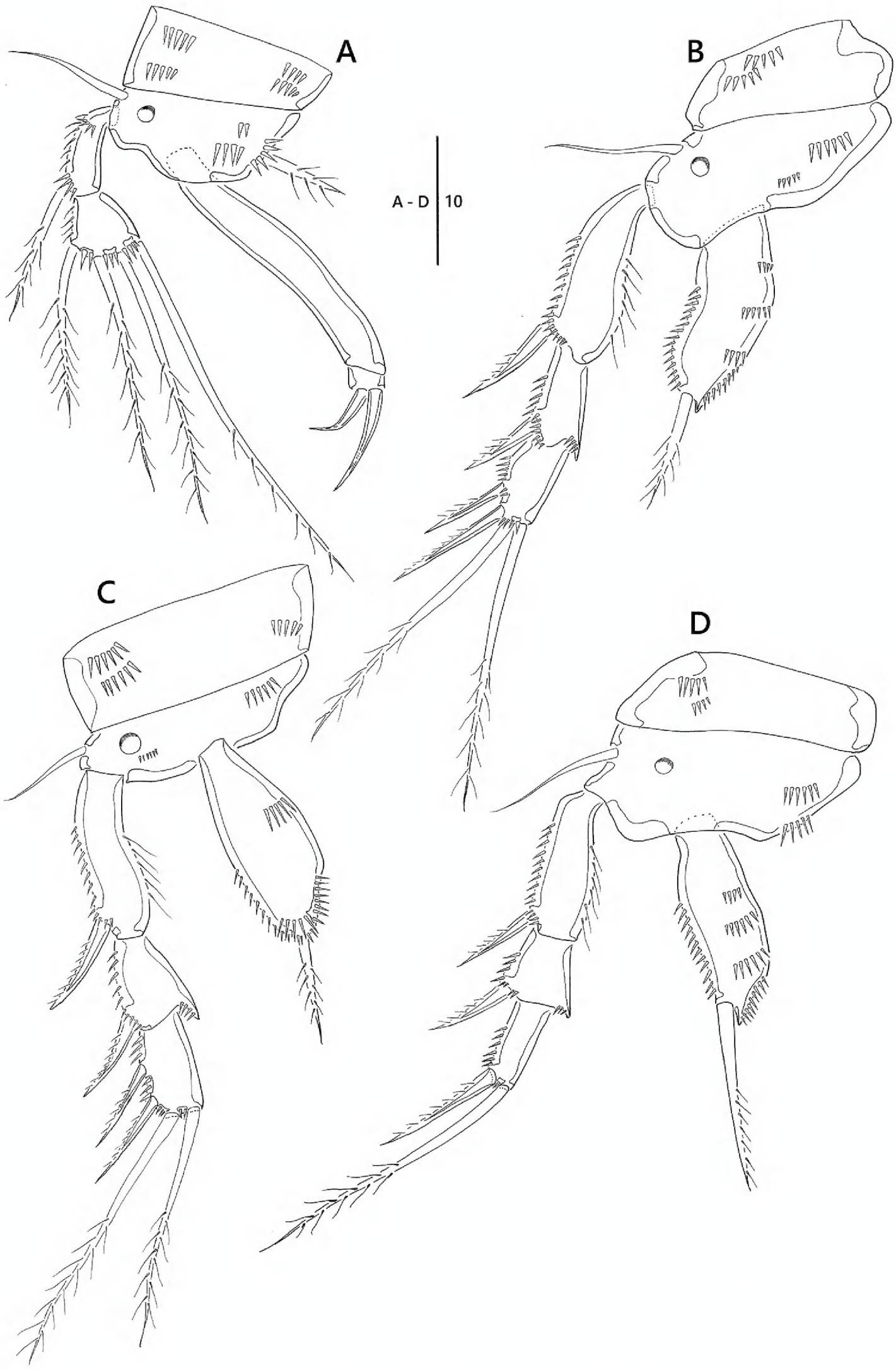

Figure 3. *Emertonia koreana* sp. n., holotype (♀). **A** P1 **B** P2 **C** P3 **D** P4. Scale bar is in μm.

Armature formula as follows:

	Exopod	Endopod
P1	0.121	0.011
P2	0.0.112	010
P3	0.0.112	010
P4	0.0.011	010

P5 (Figs 1C, 5B). Comprising medially fused benps and discrete exps; benp with one basal seta and ornamented with one pore; endopodal lobes elongated and separated by median cleft; each with two pinnate modified setae; exopod with two pinnate and one modified setae, and outer corner forming projection.

Description of male. Body (Fig. 4A) length 320 μm (n = 4, mean = 315 μm); largest width measured at posterior margin of cephalic shield: 45 μm; general body shape and ornamentation as in female; except for last two urosomites, urosome somites present strongly developed hyaline frills from dorsal to venteral (Fig. 5D); additional sexual dimorphism in A1, P5, and P6.

Antennule (Fig. 4B). Seven-segmented, short, robust, subchirocer; fifth-segment (Fig. $4B_1$) swollen, largest, forming sub-cylindrical process with one long slender seta fused basally to aesthetasc. Armature formula: 1 – [1 bare], 2 – [7 bare + 1 pinnate], 3 – [2 bare + 1 pinnate], 4 – [2 bare], 5 – [3 bare + 2 pinnate + (1 + ae)], 6 – [2 bare], 7 – [5 bare + acrothek], acrothek (Fig. $4B_2$) consisting of aesthetasc and two bare setae.

Swimming legs P1–P4 shape and setae formulae as in female (Fig. 5E, F)

P5 (Figs 4C, 5G). Comprising medially fused benp and discrete exp; benp with one basal seta; endopodal lobes weakly developed, without any element; exopod small, with two pinnate outer and one modified inner setae.

P6 (Figs 4D, 5H). Asymmetrical; each P6 with one outer and two inner setae, ornamented with one pore.

Etymology. The species name refers the type locality of new species, Republic of Korea.

Remarks. The new species *Emertonia koreana* sp. n. is closely related with *E. acutifurcata* (Mielke, 1985). They share similar shape of caudal ramus. *E. koreana* sp. n. and *E. acutifurcata* only have sub-triangular caudal ramus. Within the genus *Paramesochra*, similar morphology of caudal ramus is observed in *P. acutata acutata* Klie, 1935, *P. acutata hawaiiensis* Kunz, 1981, and *P. taeana* Back & Lee, 2010. They also have same setal formula of P1–P5. *E. koreana* sp. n. can be easily distinguished from those species based on the following unique characteristics: 1) female P5 is deeply divided into two parts in the center of both P5 baseoendopods. 2) Two setae at the end of baseoendopod are swollen near the base. In addition, the base of the innermost seta of P5 exopods is swollen, similar to setae of baseoendopod. 3) There are rectangular frills, except for the last two segments of urosomite. This structure is similar to that of *P. taeana*, but has not been reported in the genus *Emertonia* yet.

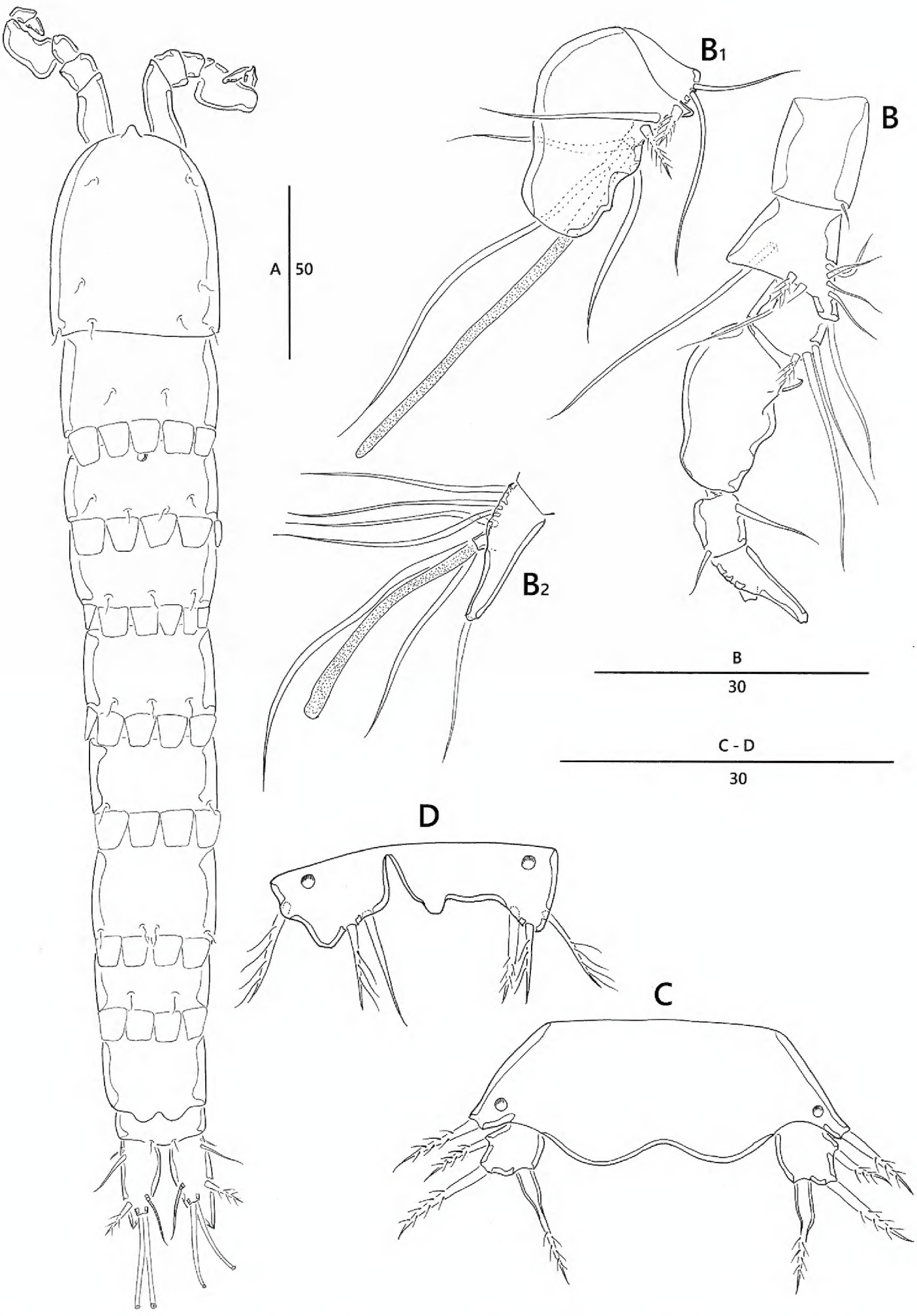

Figure 4. *Emertonia koreana* sp. n., (♂). **A** habitus, dorsal **B** antennule (**B**$_1$ fifth segment **B**$_2$ last segment) **C** P5 **D** P6. Scale bars are in μm.

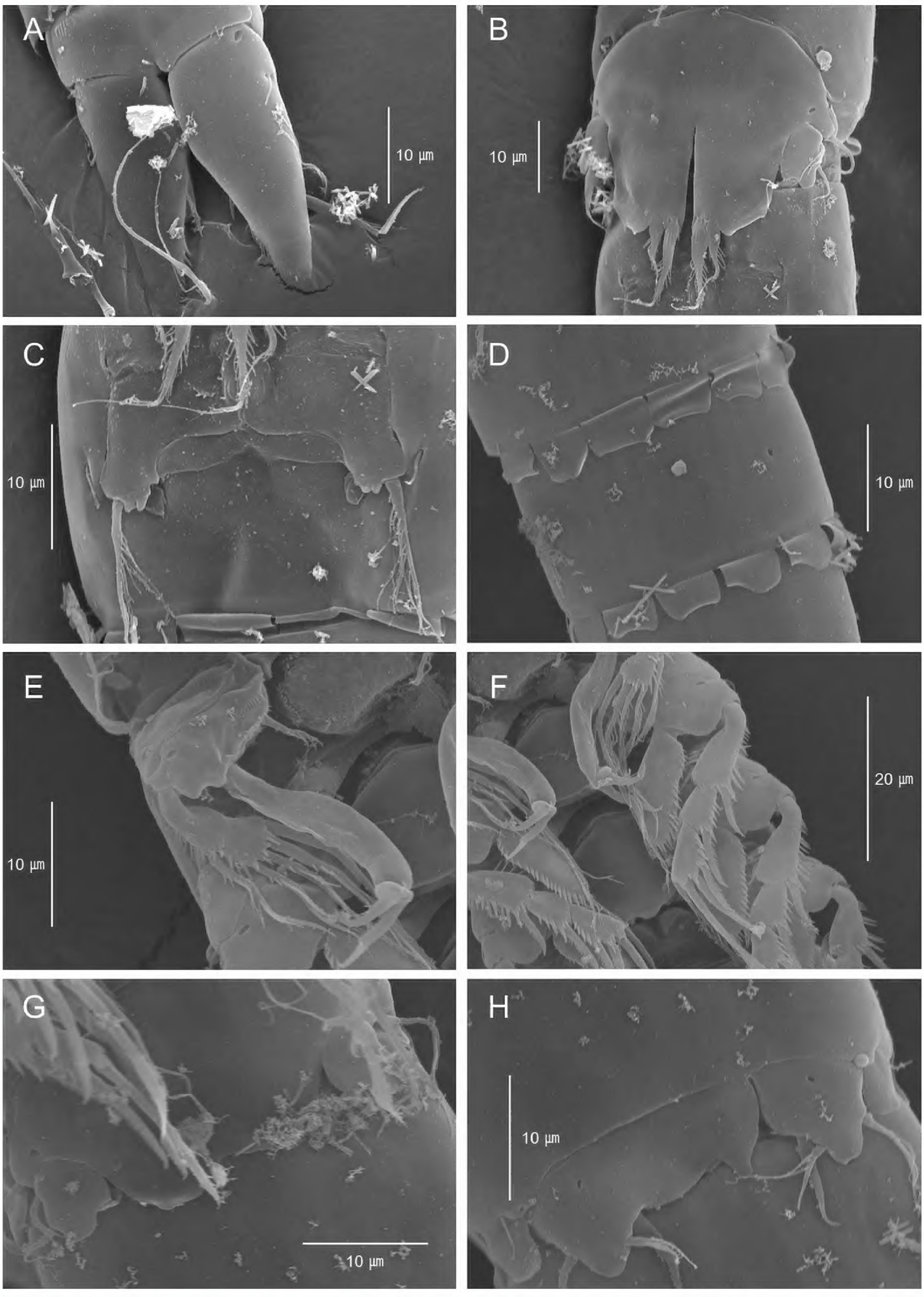

Figure 5. *Emertonia koreana* sp. n., SEM photographs. **A** caudal rami, ventral (♀) **B** P5 (♀) **C** P6 (♀) **D** sixth and seventh somites, ventral (♂) **E** P1 (♂) **F** P2 and P3 (♂) **G** P5 (♂) **H** P6 (♂).

***Emertonia simplex* sp. n.**
http://zoobank.org/2E7AB618-93AA-4942-AC8C-B3DB5183CFF9
Figs 6–11

Type locality. A subtidal zone near the Seogwipo Port in Jeju Island, Korea (33°13'33"N, 126°34'39"E), and sampled by using a grab (surface area: 0.1 m^2) on a fishing boat (Back and Lee 2014, as *Emertonia* sp. 2), depth 15–20 m, sand.

Material examined. Holotype 1♀ dissected on 7 slides (MABIK CR00241575), and paratypes: 1♂ on 5 slides (MABIK CR00241576). Additional paratypes represented by 3 ♀♀ (MABIK CR00241577 ~ CR00241579) and 2 ♂♂ (MABIK CR00241580, CR00241581) in 70 % ethanol. 2♀♀ dried, mounted on stub, and coated with gold-palladium for SEM. All samples were collected from the type locality by J. Back on 4 June 2010.

Diagnosis. *Emertonia simplex* sp. n. with four setae at P5 exopod in male, and one short Inner seta at P5 baseoendopod in female. Caudal rami rectangular, approximately 3.8 times as long as its width. Body armed with long dorsal sensilla.

Description of female. Body cylindrical, slightly depressed dorsoventrally (Figs 6A–B, 11A), with long sensilla (Fig. 11B); total body length, 390 μm (n = 7, mean = 376 μm); largest width (85 μm) measured at posterior margin of cephalic shield; body somites without hyaline frills forming quadrilateral lappets.

Prosome (Fig. 6A, B). Comprising cephalothorax, and three free pedigerous somites; Cephalothorax bell-shaped, with several sensilla; pleural areas weakly developed, posterolateral angles rounded.

Urosomites (Fig. 6A, B). Gradually tapering posteriorly; genital somite and third urosomite completely fused forming genital double-somite (Figs 9C, 11E); genital field located in proximal half of genital double-somite, with copulatory pore positioned medially, and two pores; P6 (Figs 9C, 11E) represented by narrow transverse plate, each side armed with one pinnate seta; anal somite (Fig. 9A) without anal operculum, but with rounded pseudoperculum arising from penultimate somite.

Caudal rami (Figs 9A, 11F). Rectangular, approximately 3.2 times as long as wide; with seven setae; setae III–VI located around distal margin of ramus; seta I small, bare, arising laterally; seta II bare; seta III cylindrical, bare; seta IV well developed, bare, seta V longest, pinnate in middle; seta VI bare; dorsal seta VII bi-articulate at base, bipinnate in middle.

Rostrum (Fig. 6A) small, with rounded tip, fused with cephalothorax; without sensilla.

Antennule (Fig. 6C) slender, eight-segmented; proximal segment with row of long spinules along anterior margin and blunt process on lateral margin; fourth segment with sub-cylindrical process bearing one bare seta fused basally to aesthetasc; fifth segment with sub-cylindrical process with one bare seta (Fig. $6C_1$); armature formula: 1 – [1], 2 – [7 bare + 1 spinulose], 3 – [6 bare], 4 – [2 bare + (1 + ae)], 5 – [1 bare], 6 – [2 bare], 7 – [4 bare], 8 – [5 bare + (2 + ae)]; apical acrothek consisting of one apical aesthetasc and two basally fused bare setae (Fig. $6C_2$).

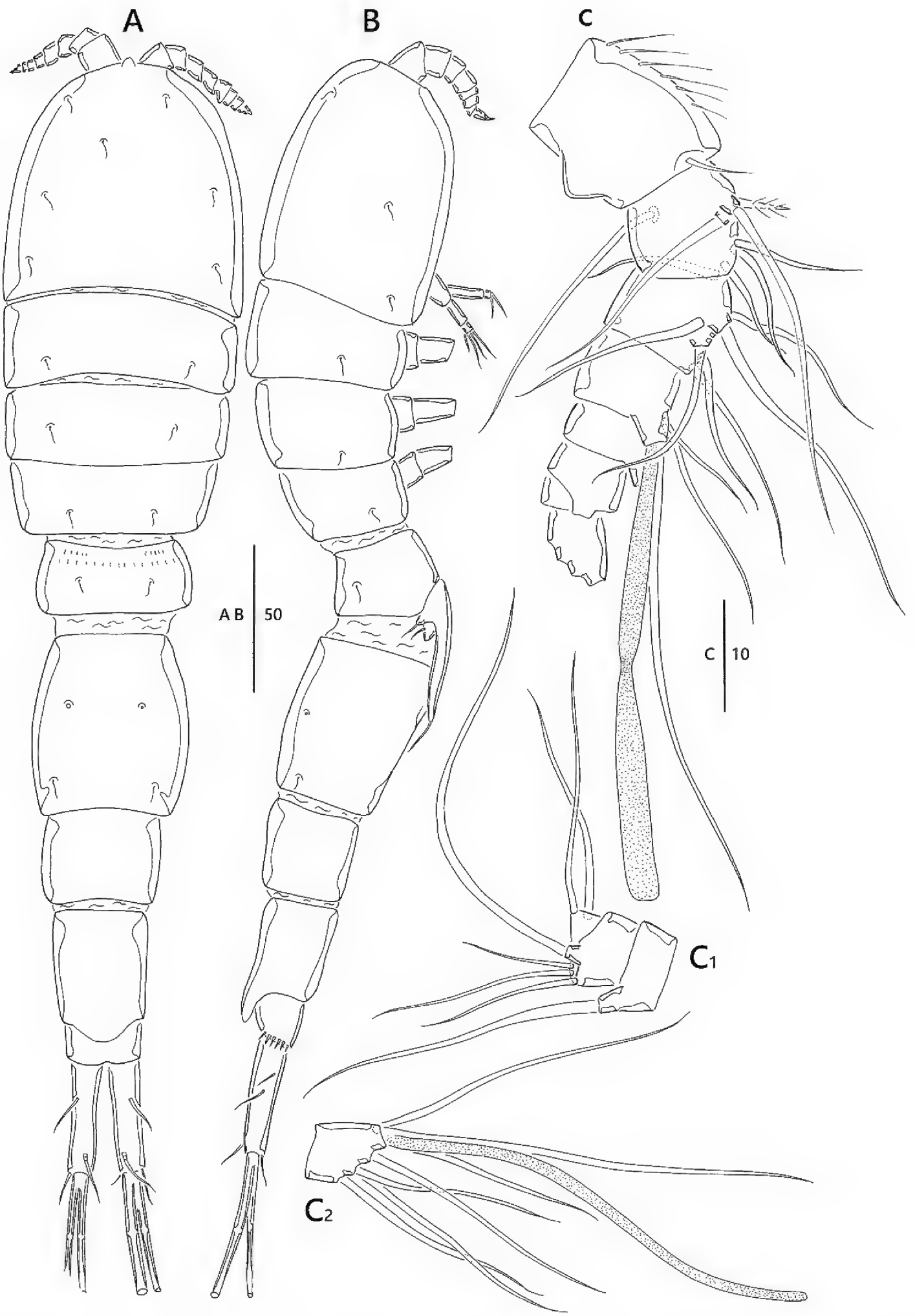

Figure 6. *Emertonia simplex* sp. n., (♀) **A** habitus, dorsal **B** habitus, lateral **C** antennule ($\mathbf{C}_1$ fifth, sixth, and seventh segments $\mathbf{C}_2$ last segment). Scale bars are in μm.

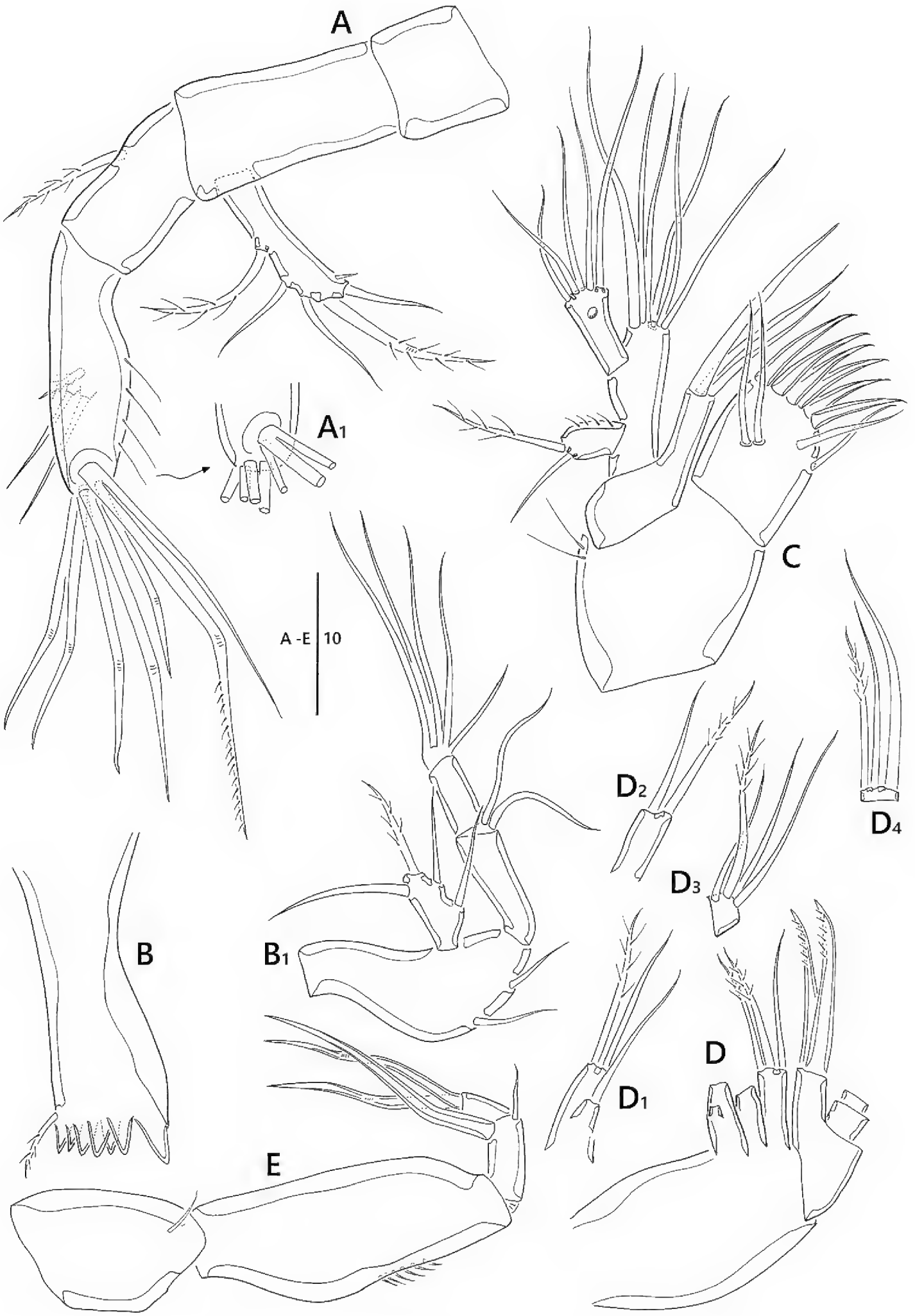

Figure 7. *Emertonia simplex* sp. n., (♀). **A** antenna (**A**$_1$ end of second segment in antenna endopod) **B** mandible (**B**$_1$ palp) **C** maxillule **D** maxilla (**D**$_1$ first endite **D**$_2$ second endite **D**$_3$ first segment of endopod **D**$_4$ second segment of endopod) **E** maxilliped. Scale bar is in μm.

Antenna (Fig. 7A). Coxa and basis without surface ornamentation; exp one-segmented, with two pinnate and three bare setae, and one spinule near outer distal corner; enp two-segmented; enp-1 with one pinnate seta, without surface ornamentation; lateral armature of enp-2 consisting of two bare setae, one pinnate seta, and long spinules along outer margin; distal armature of enp-2 (Fig. $7A_1$) consisting of six geniculate and one bare setae (one long bare seta fused at base to largest geniculate seta).

Mandible (Fig. 7B). Coxa well developed; gnathobase with seven blunt teeth and one small pinnate seta at dorsal corner; palp biramous (Fig $7B_1$), basis elongate, with two bare setae; exp one-segmented, with one pinnate and three bare setae; enp two-segmented, enp-1 1.7 times as long as enp-2, enp-1 with two bare setae; enp-2 with five setae fused at base.

Maxillule (Fig. 7C). Praecoxa subquadrate, with two long spinules; arthrite well developed, with six strong spines and two bare lateral setae, and two juxtaposed setae on surface; coxa with fused endite and three bare setae; basis fused with endites, with six setae; exp one-segmented, with one pinnate and one bare setae, and ornamented with row of spinules along inner margin; enp one-segmented, longer than exopod, with five bare setae around distal margin and one pore sub-distally.

Maxilla (Fig. 7D). Syncoxa armed with three endites; first endite (Fig. $7D_1$) bilobed, with one pinnate and two bare setae; second endite (Fig. $7D_2$) with one pinnate seta and one bare setae; distal endite with two pinnate and one bare setae; allobasis with two uni-pinnate stout setae on distal margin; enp two-segmented; enp-1 rectangular, with one pinnate seta near base, two bare and one pinnate setae; enp-2 with one pinnate and two bare setae along distal margin.

Maxilliped (Figs 7E, 11C) four-segmented; syncoxa with one bare seta; basis and ornamented with row of spinules along outer margin; enp two-segmented; enp-1 with one small bare seta laterally and one stout claw on distal margin; enp-2 with two geniculate setae.

P1 (Fig. 8A). Coxa and basis with spinules as figured; the latter with one bare outer and one bare inner setae; exp two-segmented; exp-1 longer than exp-2, the former with row of spinules along outer margin and one uni-pinnate outer spine; exp-2 with two uni-pinnate and two bare setae; enp approximately 1.8 times as long as exp; enp-1 elongate, bare, approximately five times as long as enp-2; enp-2 small, slightly longer than wide, with two claw-like setae.

P2, P3 (Figs 8B, C, 11D). Coxa with row of spinules on outer distal corner; basis with one bare outer seta, one pore near base of outer seta; exp three-segmented; exp-1 and exp-2 with one uni-pinnate spine; exp-3 with two uni-pinnate outer spines, one stout apical seta, and one pinnate seta; enp one-segmented with one pinnate apical seta.

P4 (Fig. 8D). Coxa ornamented with one row of spinules on outer distal corner; basis with one bare outer seta, one pore near base of outer seta; exp three-segmented; exp-1 and exp-2 with one uni-pinnate outer spine; exp-3 with one uni-pinnate outer spine and one apical seta; enp one-segmented, with one modified seta.

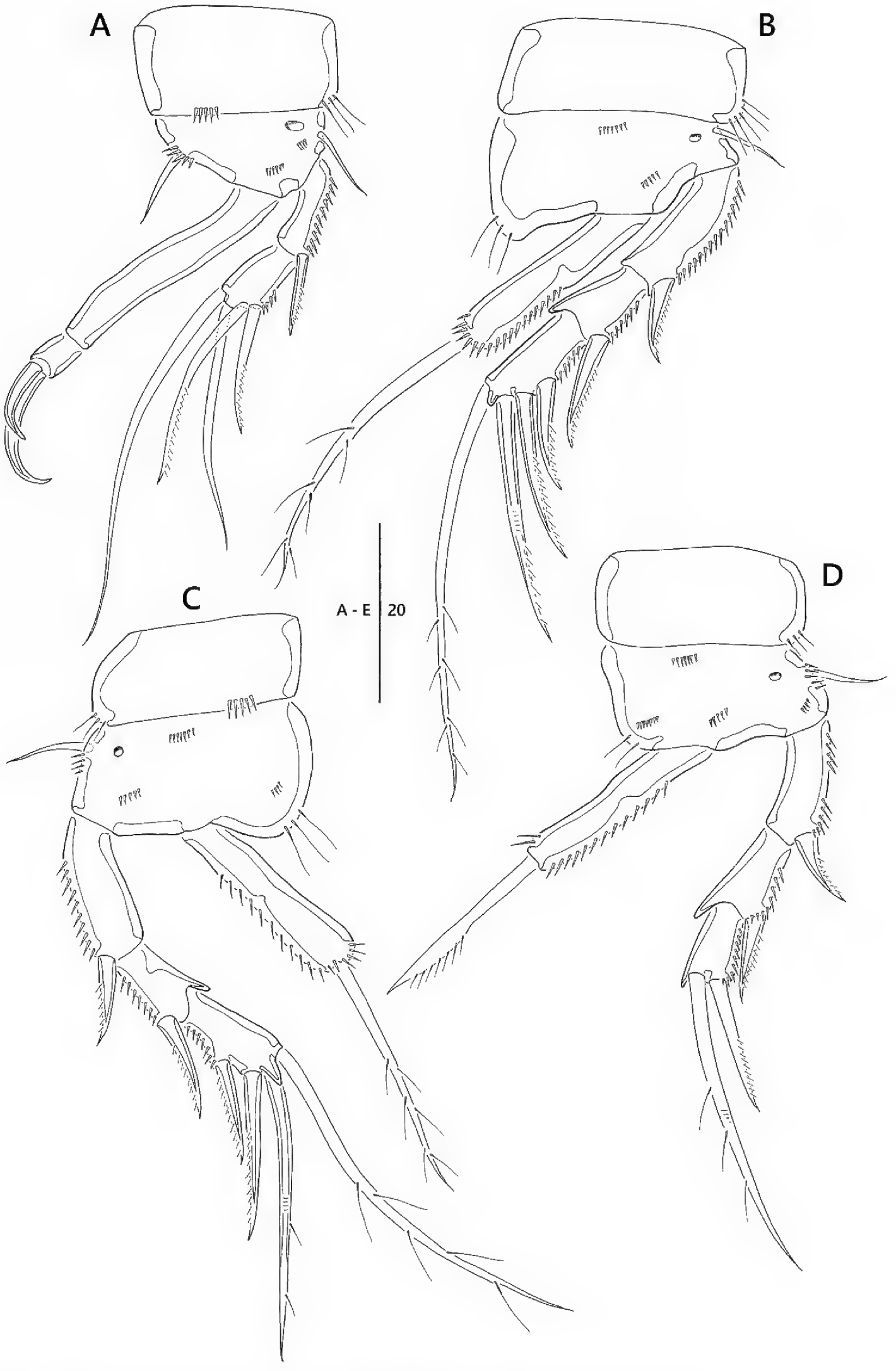

Figure 8. *Emertonia simplex* sp. n., (♀). **A** P1 **B** P2 **C** P3 **D** P4. Scale bar is in μm.

Armature formula as follows:

	Exopod	Endopod
P1	0.121	0.011
P2	0.0.112	010
P3	0.0.112	010
P4	0.0.011	010

P5 (Figs 9B, 11E) with medially fused benps and discrete exps; benp with one pinnate outer basal seta; endopodal lobes well-developed, rounded, median cleft reaching at distal margin of exp, with one shorter inner and one longer outer setae; exp well developed, with one pinnate outer seta and two bare inner setae, and ornamented with a row of long spinules along inner margin.

Description of male. Smaller than female, body length 345 μm (n = 3, mean = 344 μm) (Fig. 10A); largest width (80 μm) measured at posterior margin of cephalic shield; general body shape and ornamentation as in female except for separation of genital somite; additional sexual dimorphism in antennule, A1, P5, and P6.

Antennule (Fig. 10B). Seven-segmented, subchirocer; fifth segment (Fig. $10B_2$) swollen, largest; aesthetascs on fifth and seventh segments (Fig. $10B_1$); armature formula: 1 – [1 bare], 2 – [8 bare], 3 [5 –bare], 4 – [2 bare], 5 – [6 bare + 2 spinulose + (1 +ae)], 6 – [2 bare], 7 – [7 bare + (2 + ae)]; apical acrothek consisting of apical aesthetasc and two basally fused bare setae.

P5 (Fig. 10C). Benp confluent, forming large transverse plate, with one bare outer basal seta and one pore on either side; exp ovate bearing setules on inner margin, with two pinnate and two bare setae, innermost longest.

P6 (Fig. 10D). Clearly distinct medially, each P6 with one outer pinnate and two bare inner setae.

Etymology. The species name refers to the simple somites without hyaline frills forming quadrilateral lappets.

Remarks. The second new species, *Emertonia simplex* sp. n., shares the general characteristics of other species like *E. holsatica holsatica* (Klie, 1929) and *E. major* (Nicholls, 1939), including segmentation and setal formula of swimming legs, rectangular caudal rami, and a well-developed P5 baseoendopod and separated exopod. However, *E. simplex* sp. n. has a combination of all the following characteristics: 1) exopod of antenna has five setae. This characteristic is found in eleven species of *Emertonia*, for instance *E. regulexstans* (Mielke, 1984b), and *E. diva* (Veit-Köhler, 2005), and 2) Two claw-like setae are present on the second segment of P1, which can be found in *E. brevicaudata* (Kornev and Chertoprud, 2008), *E. californica* (Kunz, 1981), *E. insularis* (Kunz, 1981), *E. holsatica* s. str., *E. longifurcata* (Scheibel, 1975), and *E. unguiseta* (Mielke, 1984). Of these, *E. unguiseta* is the species closest to *E. simplex* sp. n. since they share all of the characteristics mentioned above. However, differences between *E. simplex* sp. n. and *E. unguiseta* are as follows: 1) *E. simplex* sp. n. has four setae at P5 exopod in male, whereas *E. unguiseta* bears only three setae, 2) the new species has a shorter inner seta at P5 baseoendopod in female, whereas

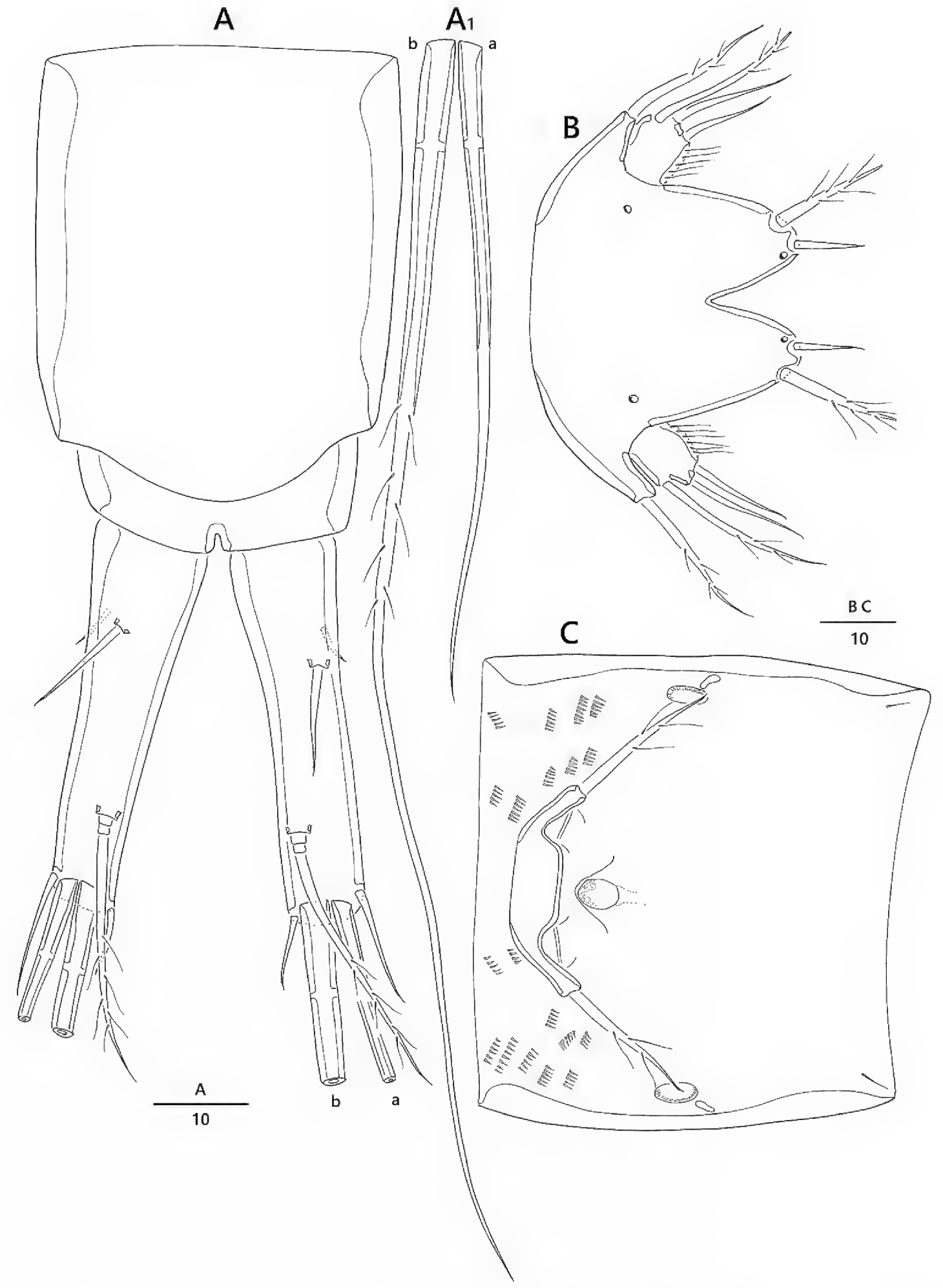

Figure 9. *Emertonia simplex* sp. n., (♀). **A** last two segments of urosomite and caudal rami **B** P5 **C** P6 and genital field. Scale bars are in μm.

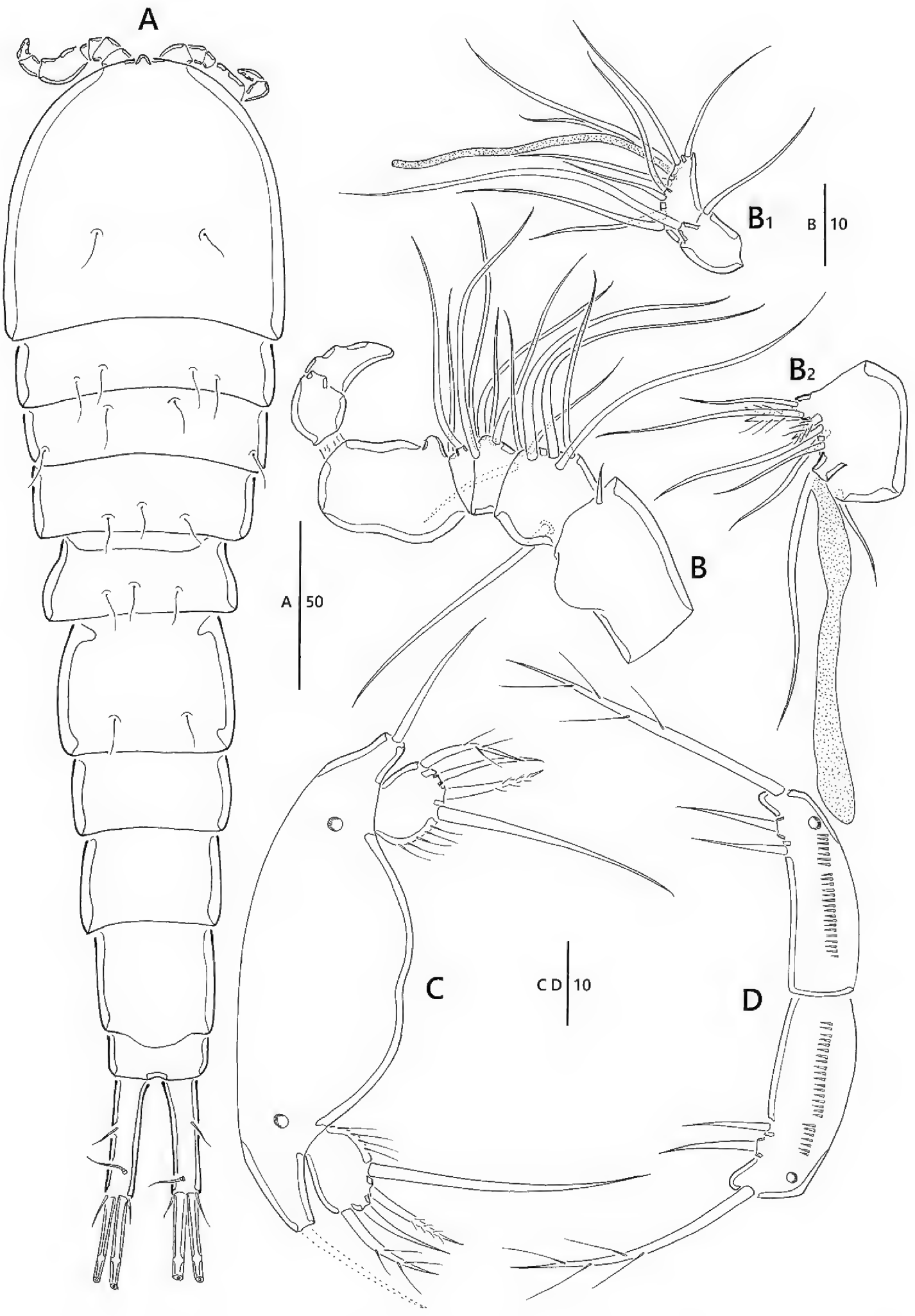

Figure 10. *Emertonia simplex* sp. n., (♂). **A** habitus, dorsal **B** antennule (**B**$_1$ last two segments **B**$_2$ fifth segment) **C** P5 **D** P6. Scale bars are in μm.

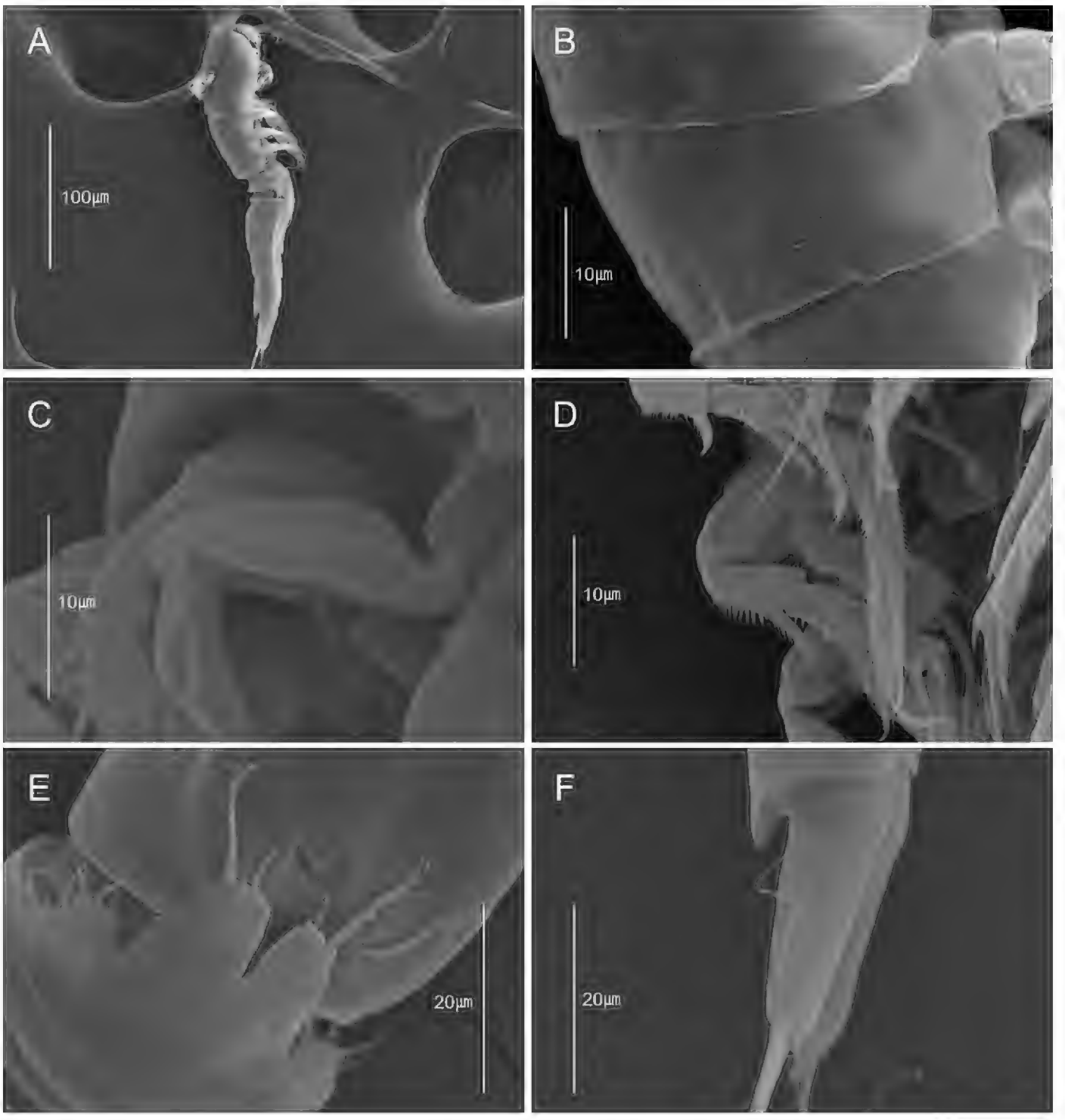

Figure 11. *Emertonia simplex* sp. n. (♀), SEM photographs. **A** habitus, lateral **B** first and second segment, lateral **C** P1 **D** P3 **C** P3 **E** P5 **F** caudal rami, lateral.

E. unguiseta bears two subequal setae, 3) the length of caudal rami is approximately 3.8 times as long as its width, whereas that of *E. unguiseta* is 3.2 times of the width. In addition, the new species has long dorsal sensilla. The major morphological characteristics of the genus *Emertonia*, including the two new species were summarized in Table 1.

Discussion. The family Paramesochridae is divided into nine genera based on segmentation, and setal formula of swimming legs. Two new species clearly belongs to the genus *Emertonia*, because of: 1) one-segmented endopods of P2–P4 with one seta each, 2) three-segmented exopods of P2–P4, and 3) the one-segmented exopod of antenna. Kunz (1981) compared the width:length ratio of the caudal rami, the characteristics of caudal setae, and the number of setae on antenna, P4, and P5. Wells (2007) also considered the characteristics of caudal seta III, and the setae on P5, and the number and position of setae in antenna for identifying species of *Emertonia*.

Table 1. Species list and morphological comparison of the species in genus *Emertonia* Wilson, 1932 based on female.

Species	A1	A2	P1			P2		P3			P4				P5		Caudal rami
	number of seg.	exp setae	exp-1	exp-2	enp-2	exp-2	exp-3	exp-2	exp-3	enp-1	exp-2	exp-3	enp-1	enp-2	exp setae	benp setae	shape width:lenth
gracilis-group																	
E. gracilis Wilson, 1932	8	3	023	·	011	0	011	0	011	010	0	011	010		3	2	square 1:2
E. pseudogracilis Krishnaswamy, 1957	7	2	122	·	011	0	012	0	012	010	0	011	010		3	1	square 1:2.5
laurentica-group																	
E. laurentica (Nicholls, 1939)	7	?	0	121	011	221	·	221	·	010	112	·	010		3	2	square 1:2
andeep-group																	
E. andeep (Veit-Köhler, 2004)	8	5	0	121	011	0	112	0	112	110	0	011	1	011	3	2	square 1:4
E. minor (Vasconcelos, Veit-Köhler, Drewes & Parreira dos Santos, 2009)	7	4	0	121	011	0	112	0	112	010	0	011	0	010	?	?	square 1:5
coelebs-group																	
E. coelebs (Monard, 1935)	7	4	0	121	011	0	112	0	112	010	1	011	110	·	3	?[1]	square 1:5
E. psammophila (Noodt, 1964)	8	3	0	121	011	0	112	0	112	010	1	011	010	·	3	2	square 1:2.5
E. furcavaricata Kunz, 1974	8	?	0	121	011	1	112	1	112	010	1	011	010	·	3	2	square 1:2.5
E. atlantica (Kunz, 1983)	7	3	0	121	011	0	112	0	112	010	1	011	110	·	3	1	square 1:3
holsatica-group																	
E. holsatica holsatica (Klie, 1929)	7	4(5)[2]	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:2
E. holsatica varians (Kunz, 1951)	7	5	0	121	011	0	112	0	112	010	0	011	110	·	3	2	square 1:3.5

Species	A1	A2	P1			P2		P3			P4				P5		Caudal rami
	number of seg.	exp setae	exp-1	exp-2	enp-2	exp-2	exp-3	exp-2	exp-3	enp-1	exp-2	exp-3	enp-1	enp-2	exp setae	benp setae	shape width:lenth
E. holsatica longicaudata (Galhano, 1970)	7	2(3)[3]	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:3.5
E. constricta constricta (Nicholls, 1935)	7	2(1)[4]	0	121	011	0	012	0	012	010	0	012 (011)[4]	010	·	3	?	square 1:3
E. constricta orotavae (Noodt, 1958)	7	2(3)[5]	0	121	011	0	012	0	012	010	0	011	010	·	3	2	square 1:2
E. constricta pacifica (Mielke, 1984a)	8	4	0	121	011	0	012	0	012	010	0	011	010	·	3	2	square 1:3
E. constricta egyptica (Mittwally & Montagna, 2001)	8	4	0	121	011	0	012	0	012	010	0	011	010	·	3	2	square 1:4
E. major (Nicholls, 1939)	9	3	0	121	011	0	112	0	012	010	0	011	010	·	3	2	square 1:3
E. pygmaea (Nicholls, 1939)	7	3	0	121	011	0	112	0	112	010	0	011	010	·	5	2	square 1:2
E. longisetosa (Krishnaswamy, 1951)	7	2	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:3
E. arenicola (Krishnaswamy, 1957)	7	2	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:3
E. capensis Krishnaswamy, 1957	7	1	0	121	011	0	012	0	012	010	0	011	010	·	3	0	square 1:2
E. minuta Krishnaswamy, 1957	7	3	0	122	011	0	012	0	012	010	0	011	010	·	3	0	square 1:2
E. enalia (Krishnaswamy, 1957)	8	1	0	022	011	0	112	0	112	010	0	011	010	·	3	2	square 1:4(?)[6]
E. wilsoni (Krishnaswamy, 1957)	7	3	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:3
E. pontica (Serban, 1959)	9	3	?	?	?	?	?	?	?	?	?	?	?	·	3	2	square 1:3.5
E. perharidiensis (Wells, 1963)	7	4	0	121	011	0	112	0	012	010	0	011	110	·	3	2	square 1:5

Species	A1	A2	P1			P2		P3			P4				P5		Caudal rami
	number of seg.	exp setae	exp-1	exp-2	enp-2	exp-2	exp-3	exp-2	exp-3	enp-1	exp-2	exp-3	enp-1	enp-2	exp setae	benp setae	shape width:lenth
E. psammobionta (Noodt, 1964)	7	3	0	121	011	0	112	0	112	010	0	011	010	·	3(2)	?	square 1:2
E. idiotes (Wells, 1967)	6	3	0	121	011	0	112	0	112	010	0	111	010	·	3	2	square 1:2.5
E. paraholsatica (Mielke, 1975)	7	4	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:3
E. longifurcata (Scheibel, 1975)	7	4	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:2.5
E. spiniger spiniger (Wells, Kunz & Rao, 1975)	7	5	0	022	020	0	112	0	112	010	0	011	110	·	3	2	square 1:6.5
E. spiniger ornata (Kunz, 1981)	7	5	0	022	020	0	112	0	112	010	0	011	110	·	3	2	square 1:9
E. masryi (Bodin, 1979)[7]	8	2	0	121	011	0	012	0	012	010	0	011	010	·	3	3	square 1:2
E. californica (Kunz, 1981)	7	3	0	121	011	0	112	0	112	010	0	020	010	·	3	2	square 1:3
E. debilis (Kunz, 1981)	8	3	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:2
E. insularis (Kunz, 1981)	8	4	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:3
E. miguelensis (Kunz,1983)	?	3	0	121	011	0	112	0	112	010	0	011	010	·	?	?	square 1:3.5
E. panamensis (Mielke, 1984a)	8	2	0	121	011	0	112	0	112	010	0	111	010	·	3	1	square 1:2
E. regulexstans (Mielke, 1984b)	8	5	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:2.3
E. similis (Mielke, 1984b)	8	5	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:3
E. unguiseta (Mielke, 1984b)	8	5	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:3.2

Species	A1	A2	P1			P2		P3			P4				P5		Caudal rami
	number of seg.	exp setae	exp-1	exp-2	enp-2	exp-2	exp-3	exp-2	exp-3	enp-1	exp-2	exp-3	enp-1	enp-2	exp setae	benp setae	shape width:lenth
E. acutifurcata (Mielke, 1985)	?	4	0	121	011	0	112	0	112	010	0	011	010	·	3	2	subtriangular 1:4
E. chilensis (Mielke, 1985)	8	4	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:2
E. diva (Veit-Köhler, 2005)	8	5	0	121	011	0	112	0	112	010	0	011	011	·	3	2	square 1:5.5
E. brevicaudata (Kornev & Chertoprud, 2008)	7	4	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:1.6
E. schminkei (Veit-Köhler & Drewes 2009).	8	5	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:9
E. clausi Pointner & Veit-Köhler, 2013	7	5(6)[8]	0	121	010	0	112	0	112	010	0	011	010	·	3	2	square 1:5.5
E. ingridae Pointner & Veit-Köhler, 2013	8	5	0	121	010	0	112	0	112	010	0	011	010	·	3	2	square 1:4.5
E. koreana sp. n. (This study)	8	2	0	121	011	0	112	0	112	010	0	011	010	·	3	2	subtriangular 1:3
E. simplex sp. n. (This study)	8	5	0	121	011	0	112	0	112	010	0	011	010	·	3	2	square 1:3.8

[1]Chappuis (1954) described P5 benp with two setae, however we doubt he described a different species instead of *E. constricta constricta*. In contrast to description of Nicholls (1935) and Marinov (1971), Chappuis (1954) described that the innermost seta of P5 exp is the longest among three setae.

[2]Mielke(1975) illustrated A2 exp with five setae.

[3]Galhano (1970) described exp of A2 with two setae in the manuscript but with three in the figure.

[4]Marinov (1971) illustrated A2 exp with one seta and P4 exp-3 with two elements.

[5]Though Masry (1970) supported the redescription of *E. constricta orotavae*, Masry's material had these differences as follow: A2 exopod with three setae (Noodt's species has two setae), baseoendopodal lobe with two bare equal length setae (Noodt's species has one longer inner and one shorter inner pinnate setae, caudal seta III ornamented with strong spinules (Noodt's species has a pinnate seta), and the innermost seta of P1 enp-2 bare (Noodt's species has a uni-pinnate seta).

[6]Krishnaswamy (1957) illustrated the habitus with very small caudal ramus. It is very difficult to calculate the ratio of width:length.

[7]The characters of *E. masryi* (Bodin, 1979) were based on *Kliopsyllus minutus* in Masry (1970).

[8]Pointner et al. (2013) described exp of A2 with six setae in the manuscript but with five in the figure.

Kunz (1981) and Huys (1987) proposed the phylogenetic position of the genera within the Paramesochridae. Kunz (1981) mentioned the diagnosis of *Kliopsyllus* based on the segmentation, and the seta formula of appendages. However, some species do not fit to the diagnosis by Kunz (1981). According to Huys' (1987) cladogram of Paramesochridae, three genera in the *Paramesochra*-group are divided by six apomorphies: 1) four setae on distal segment of P1 exopod, 2) one-segemented endopod of P2–P4, 3) three setae on the distal segment of P4 exopod, 4) one-segmented exopod of P1, 5) P1 endopod without element, and 6) two setae on distal segment of P4 exopod and one seta on P4 endopod. However, some species of *Emertonia* do not fit to Huys' cladogram as well. For example, *E. andeep* (Veit-Köhler, 2004) and *E. minor* (Vasconcelos, Veit-Köhler, Drewes & Parreira dos Santos, 2009) have two-segmented endopod of P4, *E. idiotes* (Wells, 1967) has three setae on P4 exp-3, and *E. gracilis* Wilson, 1932 and *E. pseudogracilis* Krishnaswamy, 1957 have one-segmented exopod of P1 (Table 1). Therefore the diagnosis of *Emertonia* needs to be amended as follows:

Amended diagnosis. Paramesochridae. Body cylindrical, broad anteriorly, rather flattened; with distinct separation between prosome and urosome; rostrum small, fused at base. Operculum not developed. Caudal ramus with 6 or 7 setae, seta I small or obscure. Antennule 7- or 8-segmented in female. Antennary exopod 1-segmented with 1–5 setae. Mandible biramous; exopod 1-segmented with 2–4 setae; distal segment of endopod with several basally fused setae at apex. Maxilla with 3 endites on syncoxa, first endite bilobed; endopod 1- or 2-segmented. Maxilliped with elongate basis. P1 biramous, with 2-segmented endopod and 1-or 2-segmented exopod. P2–P3 biramous, with 2- or 3-segmented exopods and 1-segmented endopods; P4 biramous, with 1- or 2-segmented endopod and 2- or 3-segmented exopod.

Five distinctive groups within genus *Emertonia* can be recognized based on segmentation and setal formula in swimming legs: 1) *gracilis*-group, 1-segmented exopod of P1; 2) *laurentica*-group, 2-segmented exopod of P2–P4; 3) *andeep*-group, 2-segmented endopod of P4; 4) *coelebs*-group, P4 exp-2 with one inner seta; 5) *holsatica*-group, 2-segmented exopod of P1, 3-segmented exopod of P2–P4, 1-segmented endopod of P2–P4, and P2–P4 exp-2 without inner seta. However, more studies including the mouthparts, and the numbers and shapes of elements on the appendages will be necessary to confirm the phylogenetic relationships among the species of *Emertonia*.

A taxonomic key for the worldwide species of *Emertonia* is constructed as follows. Unfortunately, *E. pontica* (Serban, 1959) is excluded from the key due to incomplete original description (Serban, 1959; Wells, 2007)

1	P1 exopod 1-segmented…(*gracilis*-group)	**2**
–	P1–P4 exopod 2-segmented…(*laurentica*-group)	***E. laurentica***
–	P1 exopod 2-segmented , P4 endopod 2-segmented…(*andeep*-group)	**3**
–	P1 exopod 2-segmented, P4 exopod 3-segmented; P4 exp-2 with 1 inner seta (*coelebs*- group)	**4**
–	Theses character not combined…(*holsatica*-group)	7

2	P2–P3 exp-3 with 2 setae/spines ..... ***E. gracilis***
–	P2–P3 exp-3 with 3 setae/spines ..... ***E. pseudogracilis***
3	P4 enp-2 with 2 setae..... ***E. andeep***
–	P4 enp-2 with 1 seta ..... ***E. minor***
4	P2–P3 exp-2 with 1 inner seta ..... ***E. furcavaricata***
–	P2–P3 exp-2 without inner seta..... **5**
5	Length of caudal rami 5 times as long as wide; P4 enp-1 with 2 setae... ***E. coelebs***
–	These characters not combined **6**
6	P4 enp-1 with 1 seta; P4 baseoendopodal lobe with 2 setae .... ***E. psammophila***
–	P4 enp-1 with 2 setae; P4 baseoendopodal lobe with 1 seta ..... ***E. atlantica***
7	P2 exp-3 with 3 setae/spines **8**
–	P2 exp-3 with 4 setae/spines **14**
8	P1 exp-2 with 5 setae/spines ..... ***E. minuta***
–	P1 exp-2 with 4 setae/spines **9**
9	A2 exopod with 1 seta at most ..... ***E. capensis***
–	A2 exopod with 2 setae at least **10**
10	A2 exopod with 2 setae and P5 baseoendopodal lobe with 3 setae .... ***E. masryi***
–	These characters not combined... (*E. constrictus* s. str.) **11**
11	A1 7-segmented and A2 exp with 3 setae at most..... **12**
–	A1 8-segmented and A2 exp with 4 setae..... **13**
12	P1 enp-1 length 1.6 times longer than P1 exp, length of caudal rami 3 times as long as wide ..... ***E. constricta constricta***
–	P1 enp-1 length 1.2 times longer than P1 exp, length of caudal rami 2 times as long as wide ..... ***E. constricta orotavae***
13	V-shaped baseoendopod of male P5 without setules..... ***E. constricta pacifica***
–	Each side baseoendopodal lobe almost fused ornamented with row of setules ..... ***E. constricta egyptica***
14	P4 exp-3 with 3 setae..... **15**
–	P4 exp-3 with 2 setae..... **16**
15	A2 exp with 2 elements and P5 baseoendopod with 1 seta..... ***E. panamensis***
–	A2 exp with 3 elements and P5 baseoendopod with 2 setae ..... ***E. idiotes***
16	P4 enp-1 with 2 setae..... **17**
–	P4 enp-1 with 1 setae..... **21**
17	P3 exp-3 with 3 setae..... ***E. perharidiensis***
–	P3 exp-3 with 4 setae..... **18**
18–	Length of caudal rami more than 3.5 times as long as wide; penultimate somite normal..... ***E. holsatica varians***
–	Length of caudal rami more than 5 times as long as wide..... **19**
19	Penultimate somite normal; endopod of P4 with 2 pinnate setae ..... ***E. diva***
–	Penultimate somite elongated and ornamented 2 dorsal processes/spines; endopod of P4 with 1 bare and 1 brushlike setae..... **20**
20	Length of caudal rami over 6–7 times as long as wide ..... ***E. spiniger spiniger***
–	Length of caudal rami over 9 times as long as wide ..... ***E. spiniger ornata***

21	P5 exopod with 5 setae	***E. pygmaea***
–	P5 exopod with 3 setae	**22**
22	Shape of caudal rami conical, sub-triangular	**23**
–	Shape of caudal rami square	**24**
23	A2 exopod with 4 setae; median depression between baseoendopodal lobes shallow	***E. acutifurcata***
–	A2 exopod with 2 setae; median depression between baseoendopodal lobes deeply	***E. koreana*** **sp. n.**
24	A2 exopod with 1 seta	***E. enalia***
–	A2 exopod with at least 2 setae	**25**
25	A2 exopod with 2 setae	**26**
–	A2 exopod with 3 setae	**28**
–	A2 exopod with 4 setae	**33**
–	A2 exopod with 5 setae	**38**
26	Caudal rami with inwardly pointed spine and long seta V	***E. longisetosa***
–	These characters not combined	**27**
27	End of P2–P3 enp globular; A2 exopod with 2 or 3 setae	***E. holsatica longicaudata***
–	Shape of P2–P3 endopods normal; A2 exopod with 2 setae	***E. arenicola***
28	Distal segment of P3 exopod with 3 setae	***E. major***
–	Distal segment of P3 exopod with 4 setae	**29**
29	Seta V of caudal rami consisted of two type elements, proximal half stout and distal half slender seta	***E. miguelensis***
–	Seta V of caudal rami normal	**30**
30	A1 8-segmented; P1 endopod 1.3 times longer than exopod; length of caudal rami twice as long as wide	***E. debilis***
–	These characters not combined	**31**
31	A1 7-segmented; P2 and P3 endopod with a single tiny spinule-like seta each; length of caudal rami 3 times as long as wide	***E. wilsoni***
–	These characters not combined	**32**
32	Baseoendopod of P5 with two apical setae; male exp of P5 with 3 setae	***E. californica***
–	Baseoendopod of P5 with one apical and one outer setae; male exp of P5 with four setae	***E. psammobionta***
33	Baseoendopodal lobes fused forming large plate; A1 8-segmented; male exp of P5 with four setae	***E. insularis***
–	These characters not combined	**34**
34	A1 8-segmented; P1 enp-1 ornamented with long setules; length of P1 enp-1 1.6 times as long as P1 enp-2; male P5 exp with three setae	***E. chilensis***
–	These characters not combined	**35**
35	Seta III of caudal rami blunt spine; apical seta of A2 exp stout comparison with other three setae; Caudal rami length approx. 2.5 times as long as wide	***E. longifurcata***
–	These characters not combined	**36**

36 Maxilliped enp 2-segmented; Caudal rami length approx. 1.6 times as long as wide ..... ***E. brevicaudata***
– These characters not combined **37**
37 Caudal rami length approx. 2 times as long as wide; length of P1 enp-1 7 times as long as P1 enp-2 ..... ***E. holsatica holsatica***
– Caudal rami length approx. 3 times as long as wide; length of P1 enp-1 approx. 2.7 times as long as P1 enp-2 ..... ***E. paraholsatica***
38 Baseoendopodal lobes fused forming large plate; P1 enp-1 and P1 exp equal in length ..... ***E. regulexstans***
– These character not combined **39**
39 Caudal rami length more than 5 times as long as wide **40**
– Caudal rami length under 5 times as long as wide **41**
40 Caudal rami length 9 times as long as wide; P5 exp with 1 pinnate and 2 bare setae, outermost longest ..... ***E. schminkei***
– Caudal rami length 5.5 times as long as wide; P5 exp with 3 bare setae, innermost longest ..... ***E. clausi***
41 P2–P3 enp apical seta length longer than enp **42**
– P2–P3 enp apical seta length shorter than enp **43**
42 P1 enp-2 with 1 seta ..... ***E. ingridae***
– P1 enp-2 with 2 setae/spine ..... ***E. simplex* sp. n.**
43 Length of P1 enp-1 2.5 times as long as P1 exp; male P5 exp with 3 setae .... ***E. unguiseta***
– P1 enp-1 and P1 exp same length; male P5 exp with 4 setae ..... ***E. similis***

Acknowledgements

This research was supported by Evaluation of Marine Invertebrate Bioresources (MABIK 2017M00600) sponsored by the National Marine Biodiversity Institute of Korea. Authors express a hearty thanks to Raehyuk Jung (Hanyang University) for his help in English correction of the early version of manuscript. We are also very grateful to subject editor, Dr. Kai Horst George and the two reviewers, Dr. Elena Chertoprud, and Dr. Sung Joon Song, for their help in greatly improving this manuscript.

References

Back J, Lee W (2014) Two new species of the genus *Wellsopsyllus* (Copepoda; Harpacticoida; Paramesochridae) from the Yellow Sea. Zootaxa 3895: 246–366. https://doi.org/10.11646/zootaxa.3895.3.2

Back J, Lee W (2017) Two new species of *Leptopsyllus* from Korea (Copepoda, Harpacticoida, Paramesochridae). Zookeys 665: 37–57. https://doi.org/10.3897/zookeys.665.6150

Chappuis PA (1954) Harpacticides psammiques récoltés par Cl. Delamare Deboutteville en Mediterranée. Vie et Milieu 4: 259–276.

Galhano MH (1970) Contribuição para o conhecimento da fauna intersticial em Portugal. Publições do Instituto de Zoologia "Dr. Augusto Nobre" 110: 8–206.

Huys R (2009) Unresolved cases of type fixation, synonymy and homonymy in harpacticoid copepod nomenclature (Crustacea: Copepoda). Zootaxa 2183: 1–99.

Huys R, Gee JM, Moore CG, Hamond R (1996) Synopses of the British Fauna (New Series) No. 51. Marine and Brackish Water Harpacticoids, Part 1. Field Studies Council, Shrewsbury, 352 pp.

Klie W (1929) Die Copepoda Harpacticoida der südlichen und westlichen Ostsee mit besonderer Berücksichtigung der Sandfauna der Kieler Bucht. Zoologische Jahrbücher, Systematik 57: 329–386.

Kornev PN, Chertoprud ES (2008) Harpacticoid Copepods of the White Sea: Morphology, Systematics, Ecology. KMK Scientific Press Ltd, Moscow, 379 pp. [In Russian]

Krishnaswamy S (1951) Three new species of sand-dwelling copepods from the Madras coast. Annals and Magazine of natural History 12: 273–280. https://doi.org/10.1080/00222935108654151

Krishnaswamy S (1957) Studies on the Copepoda of Madras. University of Madras, 168 pp.

Kunz H (1951) Marine Harpacticoiden aus dem Küstensand von Südwestafrika. Kieler Meeresforschungen 8: 76–81.

Kunz H (1962) Revision der Paramesochridae (Crust. Copepoda). Kieler Meeresforschungen 18: 245–257.

Kunz H (1974) Zwei neue afrikanische Paramesochridae (Copepoda Harpacticoidea) mit Darstellung eines Bewegungsmechanismus für die Furkaläste. Mikrofauna des Meeresbodens 36: 1–20.

Kunz H (1981) Beitrag zur Systematik der Paramesochridae (Copepoda, Harpacticoida) mit Beschreibung einiger neuer Arten. Mitteilungen aus dem Zoologischen Museum der Universität Kiel 1: 1–33.

Kunz H (1983) Harpacticoiden (Crustacea: Copepoda) aus dem Litoral der Azoren. Arquipélago: revista da Universidade dos Açores. Série ciências da natureza 4: 117–208.

Masry D (1970) Ecological study of some sandy beaches along the Israeli mediterranean coast, with a description of the interstitial harpacticoids (Crustacea, Copepoda). Cahiers de Biologie Marine 11: 229–258.

Marinov T (1971) Harpacticoids of the Bulgarian Black Sea coast. Proceedings of the Institute of Oceanography and Fisheries, Varna 11: 43–87. [In Bulgarian]

Mielke W (1975) Systematik der Copepoda eines Sandstrandes der Nordseeinsel Sylt. Mikrofauna des Meeresbodens 52: 1–134.

Mielke W (1984a) Einige Paramesochridae (Copepoda) von Panamá. Spixiana 7: 217–243.

Mielke W (1984b) Interstitielle Fauna von Galapagos. XXXI. Paramesochridae (Harpacticoida). Microfauna Marina 1: 63–147.

Mielke W (1985) Zwei neue *Klliopsyllus*-Arten (Copepoda) aus Chile. Studies on Neotropical Fauna and Environment 20: 97–105. https://doi.org/10.1080/01650528509360677

Mitwally H, Montagna PA (2001) Egyptian interstitial Copepoda Harpacticoida with the description of two new species and one new subspecies. Crustaceana 64: 513–544. https://doi.org/10.1163/156854001300228825

Monard A (1935) Étude sur la faune des Harpacticoïdes marins de Roscoff. Travaux de la Station biologique de Roscoff 13: 5–88.

Nicholls AG (1935) Copepods from the interstitial fauna of a sandy beach. Journal of the marine biological Association of the United Kingdom, new series 20: 379–405. https://doi.org/10.1017/S0025315400045306

Nicholls AG (1939) Some new sand-dwelling copepods. Journal of the marine biological Association of the United Kingdom, new series 23: 327–341. https://doi.org/10.1017/S0025315400013928

Noodt W (1958) Die Copepoda des Brandungsstrandes von Teneriffa (Kanarische Inseln). Abhandlungen der mathematisch-naturwissenschaftlichen Klasse, Akademie de Wissenchaften und der Literatur in Mainz 1958: 51–116.

Noodt W (1964) Copepoda Harpacticoidea aus dem Litoral des Roten Meeres. Kieler Meeresforschungen 20: 128–154.

Plum C, George KH (2009) The paramesochrid fauna of the Great Meteor Seamount (Northeast Atlantic) including the description of a new species of *Scottopsyllus* (*Intermedopsyllus*) Kunz (Copepoda: Harpacticoida: Paramesochridae). Marine Biodiversity 39: 265–289. https://doi.org/10.1007/s12526-009-0022-7

Pointner K, Kihara TC, Glatzel T, Veit-Köhler G (2013) Two new closely related deep-sea species of Paramesochridae (Copepoda, Harpacticoida) with extremely differing geographical range sizes. Marine Biodiversity 43: 293–319. https://doi.org/10.1007/s12526-013-0158-3

Scheibel W (1975) *Kliopsyllus longifurcatus* n. sp., ein sandbewohnender Harpacticoide (Copepoda) der Kieler Bucht. Crustaceana 29: 235–240. https://doi.org/10.1163/156854075X00270

Serban M (1959) Les Copépodes de la mer Noire. Note préliminaire sur les Harpacticides de la côte Roumaine. Lucrările ale Statiei Zoologice Maritime "Regele Ferdinand I" dela Agigea vol. festival 1956: 259–302.

Song SJ, Park J, Kwon B-O, Ryu J, Khim JS (2012) Ecological Checklist of the Marine and Brackish-Water Harpacticoid Copepod Fauna in Korean Waters. Zoological Studies 51: 1397–1410.

Vasconcelos DM, Veit-Köhler G, Drewes J, Santos PJP (2009) First record of the genus *Kliopsyllus* Kunz, 1962 (Copepoda Harpacticoida, Paramesochridae) from Northeastern Brazil with description of the deep-sea species *Kliopsyllus minor* sp.n. Zootaxa 2096: 327–337.

Veit-Köhler G (2004) *Kliopsyllus andeep* sp. n. (Copepoda: Harpacticoida) from the Antarctic deep sea – a copepod closely related to certain shallow-water species. Deep-Sea Research II 51: 1629–1641. https://doi.org/10.1016/j.dsr2.2004.06.027

Veit-Köhler G (2005) Results of the DIVA-1 expedition of RV "Meteor" (Cruise M48/1). First deep-sea record of the genus *Kliopsyllus* Kunz, 1962 (Copepoda: Harpacticoida) with the description of *Kliopsyllus diva* sp. n. – the most abundant member of Paramesochridae at two different sites of the Angola Basin. Organisms, Diversity and Evolution 5: 29–41. https://doi.org/10.1016/j.ode.2004.10.003

Veit-Köhler G, Drewes J (2009) *Kliopsyllus schminkei* sp. n. (Copepoda, Harpacticoida, Paramesochridae) – new copepod from the southeast Atlantic deep sea (Angola Basin). Zootaxa 2096: 313–326.

Wells JBJ (1963) Copepoda from the littoral region of the estuary of the River Exe (Devon, England). Crustaceana 5: 10–26. https://doi.org/10.1163/156854063X00020

Wells JBJ (1967) The littoral Copepoda (Crustacea) of Inhaca Island, Mozambique. Transactions of the Royal Society of Edinburgh 67: 189–358. https://doi.org/10.1017/S0080456800024017

Wells JBJ (2007) An annotated checklist and keys to the species of Copepoda Harpacticoida (Crustacea). Zootaxa 1568: 1–872.

Wells JBJ, Kunz H, Rao GC (1975) A review of the mechanisms for movement of the caudal furca in the family Paramesochridae (Copepoda Harpacticoida), with a description of a new species of *Kliopsyllus* Kunz. Mikrofauna des Meeresbodens 53: 1–16.

Wilson CB (1932) The copepods of the Woods Hole region, Massachusetts. Bulletin of the United States National Museum 158: 1–635. https://doi.org/10.5479/si.03629236.158.i